COMMONWEALTH OF PENNSYLVANIA.

DEPARTMENT OF AGRICULTURE.

BULLETIN NO. 49.

Methods for the Protection of Crops from Insects and Fungi.

By H. T. FERNALD, Ph. D.,
State Zoologist.

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WM. STANLEY RAY,
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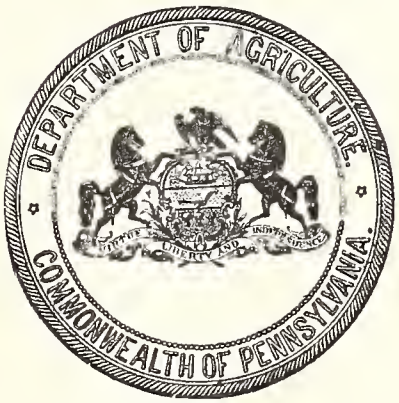

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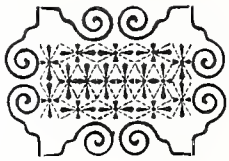

Commonwealth of Pennsylvania,
Department of Agriculture,
Division of Zoology,
Harrisburg, Pa., May 22, 1899.

Hon. John Hamilton, Secretary of Agriculture:

Sir: I have the honor to offer the following article on how and when to spray or otherwise treat crops to prevent or check the injuries caused by insects and diseases, as one of the Bulletins of the Department. The demand for such information is very great and has been met by nearly every State. No such bulletin, however, has ever been published by this Department, and it is most desirable that one should be available for distribution.

Respectfully submitted,
H. T. FERNALD,
Economic Zoologist.

A BRIEF OUTLINE OF THE BEST METHODS FOR THE PROTECTION OF CROPS FROM INSECTS AND FUNGI.

The utility of some condensed outline showing how and when to spray or otherwise treat the fruit trees, shade trees, garden and field crops, and flowers, to prevent or check injuries by insects and plant diseases, is demonstrated by the number of such publications in other States. It is practically impossible, however, to include in such a paper, all of the foes of the agriculturist and accordingly only such are considered as have been found to be most likely to be present in Pennsylvania. At the same time, treatment for the injuries touched on here, will in nearly every case, also control those not treated of, and accordingly, in this way the ground will be nearly as well covered as though all such foes were considered in detail.

In all cases, treatment according to the directions here given must be applied with judgment, as no fixed rules can be given which will hold for every case, and an ignorant adherence to the directions without a knowledge of the particular conditions of the case, may fail to give the desired results. To obtain success in the control of insect and fungous foes a knowledge of what the foe is, the best way to attack it, and when this attack is most effective, are necessary.

Any information desired on these subjects may be obtained by writing to the Division of Zoology, Department of Agriculture, Harrisburg, Pa., and the sending of samples of injury done, or of the insects or other foes causing the trouble will greatly aid in giving satisfactory answers.

APPLE.

CODLING MOTH:

1. Paris green or Arsenate of Lead as soon as blossoms have fallen. 2. Repeat about ten days later. 3. Repeat in severe cases two weeks later. 4. Repeat about August 1 for second brood. See Report of Department for 1898.

BUD-MOTH:

1. Paris green or Arsenate of Lead as soon as leaf buds become green. 2. Repeat 1 just before blossoms open. 3. Repeat 2 after blossoms fall.

CANKER-WORM:

1. Paris green or Arsenate of Lead when caterpillars appear. 2. Same ten days later. 3. Repeat every ten days if needed.

TENT CATERPILLAR:

1. Destroy tents at night by torch. 2. If any escape, treatment for Codling moth will destroy them. See report of Department for 1898.

PLUM CURCULIO:

1. Treatments 1 and 2 as for Bud moth. See also under PLUM.

BORERS:

1. Cut out those already in the tree, in May. 2. Wrap several thicknesses of paper around the trunk and fasten, about the first of June, and leave till September; cover upper part of trunk and larger limbs with whitewash and a little Paris green, at the same time. See report of Department for 1898.

OYSTER-SHELL SCALE AND SCURFY SCALE:

1. If severe, scrape the parts affected or spray with Whale oil Soap before buds swell in spring. 2. Spray about the 5th of June, with Kerosene Emulsion. 3. Repeat 2 about June 25th. See Bulletin 43 of Department.

SAN JOSE SCALE:

See under PEACH.

SCAB:

1. Spray with Bordeaux mixture and Paris green just before the blossoms open. 2. Repeat 1 as soon as blossoms have fallen. 3. Repeat 1 about ten days later, and 4, if necessary two weeks later.

BITTER-ROT:

Same treatment as for Scab.

APPLE LEAF RUST:

1. Destroy all Red Cedar trees in the neighborhood of the orchard as this fungus passes a part of its life on Cedars, causing the "Cedar Apples."

APRICOT.

See Peach.

ASPARAGUS.

ASPARAGUS BEETLES:

1. Destroy all volunteer asparagus, leaving only the shoots designed for market. 2. Let fowls run among the plants. 3. If serious, dust with fresh, dry-slacked lime while dew is on. 4. Repeat 3 every other day for ten days.

BEAN.

ANTHRACNOSE OR POD SPOT:

1. Spray with Bordeaux mixture when first true leaf has formed. 2. Repeat 1 often enough to keep leaves covered by the mixture till a week before eating pods. 3. Soaking the seed before planting, in ammoniacal copper carbonate for an hour is a very effectual treatment.

LIMA BEAN MILDEW:

1. Burn all parts of the plant at once after harvesting the crop.

BEET.

RUST:

1. Spray with Bordeaux mixture as soon as it appears. 2. Remove and burn all affected leaves.

LEAF SPOT:

1. Use Bordeaux mixture when four leaves have appeared. 2. Repeat at intervals to keep the mixture on the leaves. 3. Burn the leaves as soon as the crop has been gathered.

CABBAGE AND CAULIFLOWER.

APHIS:

1. Use Kerosene emulsion when they appear. 2. Repeat when needed till plants begin to head. 3. After heading begins use hot water or tobacco water.

CABBAGE WORM:

1. Paris green or Arsenate of Lead when the caterpillars first appear. 2. Repeat about every ten days till heading begins. 3. After heading begins, use Kerosene emulsion or hot water as often as may be needed. 4. Fresh lime applied while dew is still on is also a good method.

ZEBRA CATERPILLAR:

1. Destroy the caterpillars as soon as they appear, while they are yet in company. 2. Use Paris green when needed, till the head begins to form, or the "flower" appears in the case of cauliflower. 3. Hand picking or hot water when poisons cannot be safely used. See Report of the Department for 1898.

ROOT MAGGOT:

1. When the maggots are first noticed, make a small hole near the main root of the plant, pour in half a teaspoonful of Carbon Disulphide, and close up the hole. 2. Tarred paper cut to let the plant grow up through the centre but fitting closely to the stem and onto the ground is a good preventative method. See Report of Department for 1898.

HARLEQUIN CABBAGE BUG:

A recent addition to cabbage foes in Pennsylvania. A hard black bug with red or orange markings, nearly half an inch long when full grown. 1. Plant a trap crop of mustard early for the bugs to collect on and gather them from this or spray it with pure kerosene. 2. Gather the bugs and egg masses by hand. See Report of Department for 1898.

CLUB-ROOT:

1. Burn affected plants. 2. Strict rotation of crops. 3. Lime, 75 bushels to the acre, has been highly recommended as a preventive.

CARNATION.

ANTHRACNOSE AND RUST:

1. Bordeaux mixture on first appearance. 2. Repeat every two weeks till flowers appear. 3. After flowers appear, use ammoniacal copper carbonate every two weeks.

CELERY.

CELERY CATERPILLAR:

1. Paris green while plants are small. 2. Later, hand picking if necessary.

BLIGHT OR RUST:

1. Ammoniacal copper carbonate. 2. Repeat once a week. 3. Artificial shade is advantageous.

LEAF-BLIGHT:

Same as for Rust.

SOFT-ROT:

Chiefly in plants stored or banked in wet places. 1. Keep dry. Or 2. Place under pure water.

CHERRY.

APHIS:

1. Kerosene Emulsion when they first appear. 2. Repeat every three or four days, if necessary.

SLUG:

1. Paris green or Arsenate of Lead. 2. Repeat if needed every ten or twelve days.

CURCULIO:

See under PLUM.

BLACK KNOT:

1. Cut off the branches six inches or more below the injured place and burn them. 2. Get your neighbors to do the same to their trees. United action is necessary if the disease is to be stamped out.

ROT:

1. Bordeaux mixture before blossoms open. The addition of Paris green at this time is a good plan. 2. Repeat, without Paris green, when the fruit has set. 3. Repeat 2 twice at intervals of one to two weeks.

LEAF BLIGHT:

Same as for Rot.

CHRYSANTHEMUM.

LEAF-SPOT:

1. Bordeaux mixture on first appearance. 2. Repeat every two weeks if needed.

CORN.

WIRE-WORMS:

1. Rotation of crops. 2. Late fall plowing, repeated for several years. 3. Kainit, 1,000 pounds per acre has been highly recommended. See Report of Department for 1898.

CUT-WORMS:

1. Trap by scattering bunches of fresh clover, dipped in Paris green over the field before planting. 2. Place such bunches along the rows, later. Caution: Keep fowls and stock away.

CORN WORM OR BOLL WORM:

1. Hand picking. 2. Late fall plowing. See Report of Department for 1898.

SMUT:

1. Cut out and burn all portions affected, as soon as discovered.

CUCUMBER AND SQUASH.

STRIPED CUCUMBER BEETLE:

1. Netting till plants are well established or, 2. Powdered refuse tobacco around the stems, occasionally renewed. See Report of Department for 1898.

SQUASH BUG:

1. Burn vines immediately after gathering the crop. 2. Hand picking.

MILDEW:

1. Bordeaux mixture on first appearance. 2. Burn vines after gathering the crop.

CURRANT AND GOOSEBERRY.

CURRANT WORM:

1. Paris green or Hellebore when the worms first appear. 2. Repeat, using Hellebore every ten days or two weeks if needed.

STEM GIRDLER:

1. Cut off stem three inches below the girdled place and burn.

GOOSEBERRY FRUIT WORM:

1. Let fowls run among the plants. 2. Pick off and destroy injured fruit. 3. Rake up and burn the fallen leaves and rubbish near by, in the fall.

FOUR-LINED LEAF BUG:

1. Spray with Kerosene Emulsion one part; water five parts, in May.

LEAF-SPOT:

1. Spray with ammoniacal copper carbonate soon after leaves open. 2. Repeat with Bordeaux mixture every two weeks as long as needed. 3. Gather and burn fallen leaves in the fall.

MILDEW:

1. Spray with Potassium Sulphide solution (liver of sulphur) as the leaves begin to open. 2. Repeat every two to three weeks if needed.

EGG PLANT.

LEAF-SPOT:

1. Bordeaux mixture as soon as plants are established in the field. 2. Repeat every two to three weeks till fruit is half grown. 3. Then use ammoniacal copper carbonate.

ELM.

ELM LEAF BEETLE:

1. Spray with Paris green or Arsenate of Lead when leaves first open. 2. Repeat two weeks later. 3. Repeat if necessary.

TUSSOCK MOTH:

1. Gather and destroy the whitish egg masses in winter. 2. Repeat in July or August, before the eggs hatch and the caterpillars scatter. 3. If the caterpillars are feeding, spray with Paris green or Arsenate of Lead as often as needed.

GRAPE.

ROSE BUG:

1. Collect the insects by hand. 2. Bag the forming bunches of grapes. See Report of Department for 1898.

GRAPE-VINE FLEA BEETLE:

1. Spray with Paris green or Arsenate of Lead as soon as seen. 2. Repeat every week if necessary.

GRAPE-VINE LEAF HOPPER:

1. Dust the vines with insect powder or tobacco dust about the first of July. 2. Repeat one week later if necessary.

ANTHRACNOSE:

1. Brush the vines over with Sulphate of Iron and Sulphuric Acid solution before buds open. 2. Repeat three or four days later. Do not use after the vines start growing.

DOWNY MILDEW, POWDERY MILDEW:

1. Bordeaux mixture when leaves are fully opened. 2. Repeat about ten days before the flowers open. 3. Spray with potassium sulphide solution three weeks later if necessary.

BLACK ROT:

1. Bordeaux mixture as the buds open. 2. Repeat every two weeks if needed, till fruit is half grown; then use ammoniacal copper carbonate, repeating every week or two if necessary.

RIPE ROT:

1. Same treatment as 2 under black rot.

HOLLYHOCK.

RUST:

1. Bordeaux mixture as leaves open. 2. Repeat at intervals of ten days if needed.

MAPLE.

TUSSOCK MOTH:

See under ELM.

COTTONY MAPLE SCALE:

1. Spray with Kerosene Emulsion early in June. 2. Repeat in two weeks if necessary.

NURSERY STOCK.

SUCKING INSECTS:

1. Kerosene emulsion as soon as discovered. 2. Repeat in two weeks if necessary.

CHEWING INSECTS:

1. Paris green or Arsenate of Lead when discovered. 2. Repeat as may be needed.

FUNGOUS DISEASES:

1. Bordeaux mixture when leaves open. 2. Repeat every two weeks if needed.

OATS.

LOOSE SMUT:

Soak the seed five to ten minutes in hot water at 133 degrees F. This may be done some time before planting, if desired and hastens sprouting besides destroying the Smut.

RUST:

No good treatment known.

ONION.

MAGGOT:

1 Put the onion bed some distance from the one of the preceding year. 2. Same treatments as for the cabbage root maggot.

MILDEW:

1. Burn all the tops in the fall. 2. Rotation of crops.

SMUT:

1. Burn all refuse in the fall. 2. Start the onions on land not used for onions the preceding year and transplant—a process which pays for other reasons also.

PEACH, APRICOT, NECTARINE.

PEACH BORER:

1. Wrapping trunk as described for Apple tree Borer. 2. Mounding up earth a foot or more about June 1st, and removing about September 1. 3. Wash trunk and lower parts of limbs with whitewash and a little glue, with a tablespoonful of Paris green to each bucketful. 4. Cut out borers already in the tree. 1, 2 and 3 are alternate methods of treatment. See Report of Department for 1898.

BLACK PEACH APHIS:

1. Dig refuse tobacco powder or stems, or Kainit into the ground about the roots. 2. Spray with Kerosene Emulsion when the Aphis appears above the ground.

CURCULIO:

See under PLUM.

SAN JOSE SCALE:

1. Keep trunk and limbs covered with whitewash from June 1st, till frost appears. 2. Spray with Whale oil Soap, 1 lb. to 1 gallon of water, after the leaves are off in the fall. 3. Spray with Whale oil Soap, 2 lbs. to 1 gallon of water, before the buds start in the spring. 4. Cut back and thoroughly prune infested trees after spraying and burn the prunings. 5. Destroy badly infested plants. See Bulletin No. 43 of Department.

PEACH LEAF CURL:

1. Spray with Copper Sulphate before buds open in spring. 2. Spray with Bordeaux mixture when leaves are half grown.

PEACH ROSETTE:

No good remedy.

BROWN ROT:

1. Spray with Copper Sulphate before buds open. 2. Bordeaux mixture before flowers open. 3. Repeat 2 every ten to fourteen

days after fruit has set, until the fruit is half grown. 4. Repeat every five to seven days, using ammoniacal copper carbonate instead of Bordeaux mixture.

YELLOWS:

1. Destroy all affected trees by fire. 2. Dig out and burn roots also.

PEAR.

BORERS:

See under APPLE.

CODLING MOTH:

See under APPLE.

PEAR MIDGE:

1. Apply 1,000 lbs. of Kainit per acre, to the ground beneath the trees about the middle of June.

PEAR LEAF MITE:

1. Spray in winter with Kerosene Emulsion, 1 part; water 6 parts.

PEAR PSYLLA:

1. Spray with Whale oil Soap, 1 lb. to 1 gal. of water, in April, spraying only the trunk and larger branches.

SLUG:

See under CHERRY.

SAN JOSE SCALE:

See under PEACH.

LEAF BLIGHT OR FRUIT-SPOT:

1. Spray with ammoniacal copper carbonate as the leaves open. 2. Bordeaux mixture just before blossoms open. 3. Repeat 2 after fruit has set, at intervals of two weeks as needed.

FIRE BLIGHT:

Cut off and burn affected parts, cutting at least a foot below where the disease shows.

SCAB:

See under APPLE.

PLUM.

CURCULIO:

1. Spray with Paris green or Arsenate of Lead before the flower buds open. 2. Repeat 1 soon after the blossoms have fallen. 3. Gather the insects by jarring onto cloths beneath the tree, at night and in the morning. 4. Gather and destroy fallen plums every day. 5. Let fowls run under the trees.

PLUM LECANIUM:

1. Kerosene emulsion one part, water four parts, after leaves have fallen in the fall. 2. Repeat 1 in spring before the buds open.

SLUG:

See under CHERRY.

BORERS:

See under APPLE.

SAN JOSE SCALE:

See under PEACH.

LEAF BLIGHT:

1. Bordeaux mixture when the leaves first appear. 2. Repeat 1 after the fruit has set, every two or three weeks till fruit is three-quarters grown. 3. Now use ammoniacal copper carbonate if needed, every two or three weeks.

BROWN ROT:

See under PEACH.

BLACK KNOT:

See under CHERRY.

POTATO.

POTATO BEETLE:

1. Paris green or Arsenate of Lead as soon as insects are seen. 2. Repeat whenever needed.

POTATO STALK BORER:

1. Gather and burn all stalks after gathering the crop.

EARLY BLIGHT OR LEAF SPOT:

1. Bordeaux mixture when plants are half grown. 2. Repeat 1 every two or three weeks.

POTATO ROT:

1. Bordeaux mixture about the middle of July. 2. Repeat 1 every two weeks.

SCAB:

Soak seed potatoes in corrosive sublimate 1 ounce, water 8 gallons, for one and one-half hours before cutting them.

LATE BLIGHT OR MILDEW:

1. Bordeaux mixture when the disease appears. 2. Repeat 1 whenever needed.

QUINCE.

CURCULIO:

1. Jarring as for Plum Curculio.

LEAF BLIGHT:

1. Bordeaux mixture before flower buds open. 2. Repeat 1 when fruit has set, and every two or three weeks until fruit is three-quarters grown. 3. Ammoniacal copper carbonate later, if needed.

FIRE BLIGHT:

See under PEAR.

RASPBERRY, BLACKBERRY, DEWBERRY.

SLUG:

1. Paris green or Arsenate of Lead when insects first appear. 2. Repeat 1 two weeks later unless fruit is nearly ripe.

SNOWY TREE-CRICKET:

Cut off and burn twigs pierced, during the winter, to destroy the eggs in them.

ANTHRACNOSE:

1. Cut out all badly diseased canes. 2. Copper Sulphate solution before the buds open. 3. Bordeaux mixture after growth has commenced. 4. Repeat 3 every two or three weeks till fruit is two-thirds ripe.

ORANGE RUST:

1. Cut out and burn all diseased plants. 2. Get your neighbors to do the same.

ROSE.

APHIS AND LEAF HOPPERS:

1. Kerosene Emulsion, strong soap suds or tobacco water as often as needed.

SLUGS:

Dust with quick lime.

RED SPIDER:

Syringe with clear water. If very abundant, Kerosene emulsion.

BLACK SPOT:

Spray once a week with ammoniacal copper carbonate.

MILDEW:

1. Spray with Bordeaux mixture or ammoniacal copper carbonate as often as necessary. 2. In greenhouses fumigation with sulphur.

RUST:

1. Destroy all affected portions. 2. Gather and burn dead leaves in the fall. 3. Ammoniacal copper carbonate after leaves open.

STRAWBERRY.

SLUG:

See under RASPBERRY.

WEEVIL:

No good remedy.

LEAF BLIGHT:

1. Bordeaux mixture after the crop is gathered. 2. Repeat 1 when leaves open in the spring. 3. Repeat 2 just before blossoms open.

TOMATO.

TOMATO WORM:

1. Hand picking. 2. Paris green or Arsenate of Lead, as needed, till fruit begins to turn in color.

CORN WORM:

See under CORN.

FLEA BEETLE:

Paris green or Arsenate of Lead as often as needed.

LEAF BLIGHT:

1. Bordeaux mixture as soon as disease is discovered. 2. Repeat 1 every week or ten days.

ROT:

Same treatment as for Leaf Blight.

VIOLET.

RED SPIDER:

See under ROSE.

BLIGHT SPOT:

Bordeaux mixture when disease appears. Repeat every ten days when blossoms are not present. 3. Remove affected leaves.

WHEAT.

HESSIAN FLY:

1. Plant a trap piece about August 1st. 2. Plow under about September 10th, and plant main crop after Sept. 20th. See report of Department for 1898.

WHEAT MIDGE:

1. Plow deep soon after harvest. 2. Carefully sweep up and burn chaff and "tailings" after threshing. See Report of Department for 1898.

APHIS:

No good treatment. See Report of Department for 1898

FORMULAS.

PARIS GREEN.

	Parts.	Per bbl.
Paris green,	1 lb.	¼ lb.
Quick lime,	1 lb.	¼ lb.
Water,	200 gals.	50 gals.

This is too strong for the peach, where 2½ oz. each of Paris green and quick lime should be used instead of ¼ lb. Keep the mixture well stirred while using. To make it, mix the Paris green and the lime and add enough of the water to slake the lime, stirring while hot, then add the rest of the water.

Good Paris green gives far better results than the cheaper grades.

ARSENATE OF LEAD.

This is a comparatively new insecticide, its value having only become known within a few years. It has several advantages over either Paris green or London purple, the chief ones being that it remains more easily suspended in water, thus requiring much less stirring up during the spraying; that it shows plainly on the leaves, indicating where the spray has reached, and where it has not; and that large proportions may be used without danger of burning the leaves. It is therefore especially useful where the leaves are particularly sensitive.

	Parts.	Per bbl.
Arsenate of soda,	4 oz.	2 oz.
Acetate of lead,	11 oz.	5½ oz.
Water,	100 gals.	50 gals.

These two substances, when placed in the water dissolve rapidly, and combine, forming a fine white sediment which is the Arsenate of Lead. It can also be purchased ready for addition to the water, but it is usually better when prepared as above. It is as cheap, or in the end cheaper than Paris green, as it stays much longer on the trees before being washed off by the rains. Some persons advise the addition of two quarts of molasses to each hundred gallons of the water, but the benefit to be derived from this is questionable.

WHALE OIL SOAP.

	Parts.	Per bbl.
Whale oil soap,	2 lbs.	80 lbs.
Water,	1 gal.	40 gals.

This is much stronger than Kerosene Emulsion and should only be used during winter, when the trees are not growing. It can be used

for insects which cannot be killed by Kerosene Emulsion. In spraying for the San José Scale in the fall (see under PEACH), it should be used at the rate of one pound to a gallon of water; in the spring before the buds open, or for winter work, it can be used as above given.

KEROSENE EMULSION.

	Parts.	Per bbl.
Hard soap (shaved fine), ...	½ lb.	1 lb.
Water, ...	1 gal.	2 gals.
Kerosene, ...	2 gals.	3½ gals.

Dissolve the soap in the water, which should be boiling, and while it is very hot pour the suds into the kerosene; then churn it with a spray pump till it changes to a creamy mass, and then to a soft, butter-like substance. This should keep for some time. When it is wished to use it, add one part of it to nine times as much water, mix well, and spray the plants. The water should be soft water, or else have some soda added to it.

For the Four-lined Leaf bug take one part of the Emulsion and five parts of water.

TOBACCO WATER.

Place tobacco stems or refuse tobacco in enough hot water to cover; let stand several hours. Take one part of this to three or four of water, and spray over the plants.

CARBON DISULPHIDE.

To be obtained of druggists at about thirty cents per pound. In using, avoid bringing it near fire or even hot steam pipes as it catches fire easily. Avoid breathing it also.

HELLEBORE.

May be applied either as a powder or in water. If used as a powder it may advantageously be mixed with an equal amount of flour, which causes it to remain better on the leaves. For use with water one ounce of fresh Hellebore is mixed with three gallons of water.

INSECT POWDER.

Insect Powder is sometimes sold under the names Pyrethrum and Buhach. It may be applied as the dry powder, when the plant is wet with dew. It may also be mixed with flour and used in that way, or it may be used in an alcoholic solution as follows:

Insect powder (by weight), ...	1 part.
Alcohol (by weight), ...	4 parts.

Put the two in a tight vessel and leave there for eight days, shaking occasionally; then filter and spray over the plants.

It should be remarked that Insect Powder is only of value when fresh and full strength. Unfortunately it is difficult to obtain it fresh, and much of it is so adulterated as to be practically worthless.

LIME.

Lime is often of much value as an insecticide, either as whitewash, sometimes with enough Paris green added, to give it a slight greenish tinge, or as quick lime to be dusted onto the insects. When used in the preparation of Paris green it is added to combine with the free arsenic present, which would burn the leaves, if left uncombined.

NORMAL OR 1.6 PER CENT. BORDEAUX MIXTURE.

Copper sulphate (Blue vitriol), ...	6 pounds.
Quick lime (Good stone lime), ...	4 pounds.
Water, ...	50 gallons.

Dissolve the copper sulphate by putting it in a bag of coarse cloth and hanging this in a vessel containing 4 to 6 gallons of water. Use an earthen or wooden vessel. After the copper sulphate is dissolved, dilute with water to 25 gallons. Slake the lime and add 25 gallons of water. Mix the two and keep thoroughly stirred while using. If the mixture is to be used on peach foliage it is advisable to add two pounds more of lime to the above formula.

BORDEAUX MIXTURE AND PARIS GREEN.

Mix 4 ounces of Paris green as prepared above, with 50 gallons of normal Bordeaux mixture.

AMMONIACAL COPPER CARBONATE.

Copper carbonate, ...	5 ounces.
Ammonia, ...	3 pints.
Water, ...	45 gallons.

Make a paste of the copper carbonate with a little of the water. Dilute the ammonia with 7 or 8 times its bulk of water. Add the paste to the diluted ammonia and stir until dissolved. Add enough water to make up to the 45 gallons. Let it settle and use the clear blue liquid only. Do not make this up long before using as it loses its strength on standing. It is used when the fruit is so nearly ripe that Bordeaux mixture would produce stains if it were used.

POTASSIUM SULPHIDE SOLUTION.

(Liver of Sulphur.)

Potassium sulphide,	$\frac{1}{2}$ to 1 ounce.
Water,	1 gallon.

Particularly good for surface mildews but loses its strength upon standing, so should be used at once after making.

SULPHATE OF IRON AND SULPHURIC ACID SOLUTION.

Water (hot),	100 parts.
Iron sulphate (green vitriol),	as much as the water will dissolve.
Sulphuric acid (commercial),	1 part.

Make the mixture with much care, as heat is produced. Use on plants when dormant only, applying with brushes or sponges, as the solution is injurious to spraying machinery.

CORROSIVE SUBLIMATE.

This dissolves slowly and but slightly in water. The process may be hastened by heating the water.

GENERAL REMARKS.

In the treatment of fruits by sprays it should be remembered that the substances used are in almost every case poisonous. It is accordingly necessary to avoid spraying at times when fruit is nearly ripe, both on account of the possibility of placing poison on the fruit just before it is picked, and because of the danger of staining it, as would be the case if certain solutions were used.

Spraying solutions often need to be carefully strained, and it is advisable to do this when putting them into the barrel or other receptacle from which they will pass through the spray pump. Nozzles will clog from larger lumps in the fluid, and care should be taken to avoid this as far as possible. Every pump should have an agitator attached to keep the mixture well stirred in the barrel, and it should not be expected that the same nozzle will do first class work with every spraying mixture given. Some nozzles are especially adapted to one kind of spray, and others to other sprays. Above all, an intelligent knowledge of what is causing the injury, and exactly how and when to take the proper steps to control it, should be one of the ingredients added to every formula here given.